

WHAT IS CLAIMED IS:

1. A projection system comprising:
a first panel;
a first light source adjacent to the first panel;
a light-directing element coupled to the first panel; and
a first oblique anisotropic compensation element adjacent to the first panel, wherein
the first oblique anisotropic compensation element is configured to change a
state of polarization of off-normal incident light.
2. A projection system according to claim 1 wherein the anisotropy of the first
oblique compensation element is positive anisotropy.
3. A projection system according to claim 1 wherein the anisotropy of the first
oblique compensation element is selected from the group consisting of: positive anisotropy,
negative anisotropy, and biaxial anisotropy.
4. A projection system according to claim 1 and further comprising at least a
second panel and at least a second oblique anisotropic compensation element adjacent to the
second panel, wherein the first and second panels are operable to modulate first and second
light spectra, respectively.
5. A projection system according to claim 4 wherein one of the first and second
oblique anisotropic compensation elements has positive anisotropy, and the other of the first
and second oblique anisotropic compensation elements has negative anisotropy.

6. A projection system according to claim 5 wherein one of the first and second light spectra is blue and the other is red or green, and wherein the oblique anisotropic compensation element having the positive anisotropy is used to change a state of polarization of off-normal incident light in the first light spectrum and wherein the oblique anisotropic compensation element having the negative anisotropy is used to change a state of polarization of off-normal incident light in the second light spectrum.

7. A projection system according to claim 4, wherein at least one of the first and second oblique anisotropic compensation elements are splayed relative to their respective adjacent panels.

8. A projection system according to claim 7, wherein both of the first and second oblique anisotropic compensation elements are splayed and wherein their splays are symmetric to each other.

9. A projection system according to claim 7, wherein both of the first and second oblique anisotropic compensation elements are splayed and wherein their splays are asymmetric to each other.

10. A projection system according to claim 7, wherein both of the first and second oblique anisotropic compensation elements have the same anisotropy.

11. A projection system according to claim 7, wherein both of the first and second oblique anisotropic compensation elements have different anisotropies.

12. A projection system according to claim 7, wherein at least one of the first and second oblique anisotropic compensation elements has biaxial anisotropy.

13. A projection system according to claim 1, further comprising at least one micro-lens array adjacent to the first panel.

14. A projection system according to claim 1, wherein the light-directing element is an X-cube.

15. A projection system according to claim 1, wherein the first oblique anisotropic compensation element is substantially optimized for maximum azimuth-averaged contrast.

16. A projection system according to claim 1, wherein the first panel is a liquid crystal panel.

17. A projection system according to claim 1, wherein the oblique anisotropic compensation element includes a polymeric liquid crystal material.

18. A projection system according to claim 1, wherein the oblique anisotropic compensation element is a multilayer compensation element.

19. A projection system according to claim 1 and further comprising a second oblique anisotropic compensation element adjacent to the first panel.

20. A projection system according to claim 19, wherein the first and second oblique anisotropic compensation elements are on the same side of the first panel.

21. A projection system according to claim 19, wherein the first and second oblique anisotropic compensation elements are on the opposite sides of the first panel.
22. A projection system according to claim 13, wherein the first oblique anisotropic compensation element is on the low f-number side of the at least one micro-lens array.
23. A projection system according to claim 1, wherein the first panel and the first oblique anisotropic compensation element are formed on a common substrate.
24. A projection system according to claim 23, wherein the first panel is the substrate on which the first oblique anisotropic compensation element is formed.
25. A projection system according to claim 1, wherein the first oblique anisotropic compensation element has a tilt angle that ranges from about 0° to about 50°.
26. A projection system according to claim 1, wherein the first oblique anisotropic compensation element is splayed relative to the first panel.
27. A projection system comprising:
- a first panel;
 - a first light source coupled to the first panel;
 - a light-directing element coupled to the first panel; a first oblique compensation element adjacent to the first panel, wherein the first oblique compensation element is configured to change a state of polarization of off-normal incident light;

a second oblique compensation element;
a second panel adjacent to the second oblique compensation element;
a second light source coupled to the second panel;
a third oblique compensation element;
a third panel adjacent to the third oblique compensation element; and
a third light source coupled to the third panel,
wherein the first, second and third oblique compensation elements are configured to
change a state of polarization of off-normal incident light, and
wherein the light-directing element is configured to combine light modulated by the
first, second, and third panels to form an image.

28. A projection system according to claim 27, wherein at least one of the oblique compensation elements is splayed with respect to its corresponding adjacent panel.

29. A projection system according to claim 27, further comprising:
a fourth oblique compensation element adjacent to the first panel;
a fifth oblique compensation element adjacent to the second panel; and
a sixth oblique compensation element adjacent to the third panel.

30. A projection system according to claim 29, wherein at least one of the oblique compensation elements are splayed relative to its respective panel.

31. A projection system according to claim 27, further comprising at least one micro-lens array adjacent to at least one of the first, second and third panels.

32. A projection system according to claim 27, wherein at least one of the oblique compensation elements is substantially optimized for maximum azimuth-averaged contrast.

33. A projection system according to claim 27, wherein the light-directing element is an X-cube.

34. A projection system according to claim 27, wherein the first, second, and third panels are liquid crystal panels.

35. A projection system according to claim 29, wherein the oblique compensation elements include polymeric liquid crystal material.

36. A projection system according to claim 29, wherein the oblique compensation elements are multilayer compensation elements.

37. A projection system according to claim 27, wherein a corresponding pair of the oblique compensation elements are on the same side of their corresponding adjacent panel.

38. A projection system according to claim 27, wherein a corresponding pair of the oblique compensation elements are on the opposite sides of their corresponding adjacent panel.

39. A projection system according to claim 31, wherein the oblique compensation elements corresponding to each panel are on the low f-number side of the at least one micro-lens array.

40. A projection system according to claim 29, wherein substrates that form the first, second, and third panel include the corresponding oblique compensation elements.

41. A projection system according to claim 29, wherein the oblique compensation elements have tilt angles that range from about 0° to about 50°.

42. A liquid crystal projection device comprising:

a first oblique-splayed compensation element having a first splay tilt profile;

a second oblique-splayed compensation element having a second splay tilt profile;

and

a liquid crystal panel adjacent the first and second oblique-splayed compensation elements,

wherein the first splay tilt profile differs from the second splay tilt profile and the oblique-splayed compensation elements are configured to change a state of polarization of off-normal incident light.

43. A liquid crystal projection device according to claim 43, wherein the oblique-splayed compensation elements are substantially optimized for maximum azimuth-averaged contrast.

44. A method for compensating a projection system comprising:

compensating at least one panel with a first oblique anisotropic compensation element;

compensating the at least one panel with a second oblique anisotropic compensation element; and

forming an image with at least one light directing element using light modulated by the at least one panel,
wherein the first and second oblique anisotropic compensation elements are configured to change a state of polarization of off-normal incident light, and wherein the first and second oblique anisotropic compensation elements are substantially optimized for maximum azimuth-averaged contrast.

45. A method according to claim 44, further comprising focusing light onto the at least one panel with at least one micro-lens array.

46. A method according to claim 45, wherein the at least one panel is a liquid crystal panel.

47. A method according to claim 45, wherein the first and second oblique anisotropic compensation elements include polymeric liquid crystal material.

48. A method according to claim 47, wherein at least one of the first and second oblique anisotropic compensation elements is splayed.

49. A method according to claim 47, wherein the first and second oblique anisotropic compensation elements are on the same side of the at least one panel.

50. A method according to claim 47, wherein the first and second oblique anisotropic compensation elements are on the opposite sides of the at least one panel.

51 A method according to claim 47, wherein the first and second oblique anisotropic compensation elements have the same anisotropy sign.

52 A method according to claim 47, wherein the first and second oblique anisotropic compensation elements have a different anisotropy sign.

53. A method according to claim 47, wherein the first and second oblique anisotropic compensation elements are splayed with respect to the at least one panel.

54. A projections system comprising:
a panel;
a first oblique anisotropic compensation element optically located on a first side of the panel;
a second oblique anisotropic compensation element located between the first oblique anisotropic compensation element and the first side of the panel,
wherein the first oblique anisotropic compensation element has an average tilt with respect to the average tilt of a first planar portion of the panel adjacent to the first side of the panel and the second oblique anisotropic compensation element has an average tilt with respect to the average tilt of a second planar portion of the panel adjacent to the second side of the panel.

55. A projection system according to claim 54, wherein at least one of the first and second oblique anisotropic compensation elements have a splayed structure.

56. A projection system according to claim 55, wherein the first and second portions of the panel have splayed structures and wherein the first and second oblique anisotropic compensation elements both have splayed structures.

57. A projection system according to claim 56, wherein the splay the first oblique anisotropic compensation element is parallel to the splay of the first portion of the panel.

58. A projection system according to claim 56, wherein the splay of the second oblique anisotropic compensation element is parallel to the splay of the second portion of the panel.

59. A projection system according to claim 56 wherein the splay of the first oblique anisotropic compensation element is coplanar with the splay of the first portion of the panel and has a negative tilt angle with respect to the first portion of the panel, and the splay of the second oblique anisotropic compensation element is coplanar with the splay of the second portion of the panel and has a negative tilt angle with respect to the second portion of the panel.

60. A projection system comprising:
a first panel;
a first light source adjacent to the first panel;
a light-directing element coupled to the first panel; and
a first oblique anisotropic compensation element adjacent to the first panel,
wherein the first oblique anisotropic compensation element is configured to change a state of polarization of off-normal incident light, and
wherein the anisotropy of the first oblique compensation element is positive anisotropy.

61. A projection system according to claim 60 wherein the anisotropy of the first oblique compensation element is selected from the group consisting of: positive anisotropy, negative anisotropy, and biaxial anisotropy.

62. A projection system according to claim 60 and further comprising at least a second panel and at least a second oblique anisotropic compensation element adjacent to the

second panel, wherein the first and second panels are operable to modulate first and second light spectra, respectively.

63. A projection system according to claim 62 wherein one of the first and second oblique anisotropic compensation elements has positive anisotropy, and the other of the first and second oblique anisotropic compensation elements has negative anisotropy.

64. A projection system according to claim 63 wherein one of the first and second light spectra is blue and the other is red or green, and wherein the oblique anisotropic compensation element having the positive anisotropy is used to change a state of polarization of off-normal incident light in the first light spectrum and wherein the oblique anisotropic compensation element having the negative anisotropy is used to change a state of polarization of off-normal incident light in the second light spectrum.

65. A projection system according to claim 62, wherein at least one of the first and second oblique anisotropic compensation elements are splayed relative to their respective adjacent panels.

66. A projection system according to claim 65, wherein both of the first and second oblique anisotropic compensation elements are splayed and wherein their splays are symmetric to each other.

67. A projection system according to claim 65, wherein both of the first and second oblique anisotropic compensation elements are splayed and wherein their splays are asymmetric to each other.

68. A projection system according to claim 65, wherein both of the first and second oblique anisotropic compensation elements have the same anisotropy.
69. A projection system according to claim 65, wherein both of the first and second oblique anisotropic compensation elements have different anisotropies.
70. A projection system according to claim 65, wherein at least one of the first and second oblique anisotropic compensation elements has biaxial anisotropy.
71. A projection system according to claim 60, further comprising at least one micro-lens array adjacent to the first panel.
72. A projection system according to claim 60, wherein the light-directing element is an X-cube.
73. A projection system according to claim 60, wherein the first oblique anisotropic compensation element is substantially optimized for maximum azimuth-averaged contrast.
74. A projection system according to claim 60, wherein the first panel is a liquid crystal panel.
75. A projection system according to claim 60, wherein the oblique anisotropic compensation element includes a polymeric liquid crystal material.
76. A projection system according to claim 60, wherein the oblique anisotropic compensation element is a multilayer compensation element.

77. A projection system according to claim 60 and further comprising a second oblique anisotropic compensation element adjacent to the first panel.

78. A projection system according to claim 77, wherein the first and second oblique anisotropic compensation elements are on the same side of the first panel.

79. A projection system according to claim 77, wherein the first and second oblique anisotropic compensation elements are on the opposite sides of the first panel.

80. A projection system according to claim 71, wherein the first oblique anisotropic compensation element is on the low f-number side of the at least one micro-lens array.

81. A projection system according to claim 60, wherein the first panel and the first oblique anisotropic compensation element are formed on a common substrate.

82. A projection system according to claim 81, wherein the first panel is the substrate on which the first oblique anisotropic compensation element is formed.

83. A projection system according to claim 60, wherein the first oblique anisotropic compensation element has a tilt angle that ranges from about 0° to about 50°.

84. A projection system according to claim 60, wherein the first oblique anisotropic compensation element is splayed relative to the first panel.